

himself much to theoretical astronomy. During his later years he was occupied in the observations of circumpolar stars between $+80^{\circ}$ and the Pole, which sedulously engaged him until 1869, when he joined in the zone observations of the "Astronomische Gesellschaft," undertaking the zone between $+75^{\circ}$ and $+80^{\circ}$ Declination. The reduction of these observations was completed in 1883, and the printing, which was then begun, has already made considerable progress.

Kowalski was endued with great energy and power for work, but characterised by a modesty which made him shrink from publishing his works until he had severely criticised them.

From the interesting account of his life given in the *Viertel-jahrsschrift* of the "Astronomische Gesellschaft" we learn that Kowalski has left much valuable scientific work which has not been published. The ability and conscientiousness displayed by him in all his researches are an assurance that astronomy would be greatly enriched by their publication.

An affection of the heart, from which he had suffered for some years, suddenly terminated his life on July 9, 1884.

He was a corresponding member of the St. Petersburg Academy of Sciences, and honorary member of the St. Petersburg University.

He was elected an Associate of this Society on November 13, 1863.

JOHANN FRIEDRICH JULIUS SCHMIDT, Director of the Observatory at Athens, whose death was briefly announced in the last Annual Report, was born at Eutin, in Oldenburg, on October 25, 1825. At a very early age his friends soon perceived that he possessed a great inclination for astronomical pursuits, and scarcely had he entered his teens before he gave decided indications of those talents for quickness and acuteness in observing which have marked his scientific career throughout his life. What perhaps encouraged young Schmidt at this early period more than anything else in his enthusiastic taste for the observation of natural phenomena, and more especially for those relating to the physical features of the lunar disk, was the accidental circumstance that when only fourteen years old a copy of Schroeter's work on the Moon, *Selenotopographische Fragmente*, came by some means into his possession. The perusal of this work produced on his mind an intense desire to study on his own account, at some future time, the various peculiarities of the shadow-throwing hills and craters; and to this early influence we must attribute the origin of that life-long devotion which he afterwards gave to the subject of selenography. Fortunately for the young student at this commencement of his career, his father happened to have a small low-power telescope, and with this instrument, attached to a lamp-post, Schmidt made, in 1839, his first attempts at sketching some of the more prominent craters and their surroundings. For a year or two he had no

other instrumental assistance; but imperfect as his telescope was, it afforded him much pleasure and increased his enthusiasm for lunar sketching. Nearly all his spare time was now devoted either to the examination of Schroeter's work or in observing with his small telescope, the mounting of which he had, however, soon improved by constructing for it a rough wooden stand, so that his observations were greatly facilitated. The lunar sketches young Schmidt had made with this small telescope at the beginning of his career were comparatively much rougher than the more finished drawings executed in later years under more favourable circumstances, but they were of great advantage to him at the time, for they were the means of giving him most excellent practice as a student, both in the education of his eye and in the power of delineating the more delicate portions of the Moon's surface. But Schmidt himself knew well that these early observations, having been made under many difficulties, and with so small a telescope, must naturally have been inferior to those made in after years, and he was therefore probably wise in ultimately rejecting them in the final formation of his lunar map.

Through the kindness of a gentleman who had noticed the youth's great zeal for astronomy, and that he was evidently encumbered with many practical difficulties, Schmidt procured, in 1841, the loan of a 4-feet Dollond Telescope, having a power of 15 to 20. This addition to his instrumental means enabled him to prosecute his researches with increased success. Soon after this he became a student at the Gymnasium at Hamburg, but at the same time he never failed to avail himself of every opportunity to continue his observations. This predilection for the study of lunar objects received a great stimulus during a visit, in the month of July 1841, to the Altcna Observatory. Here, under the guidance of Dr. Petersen, Schmidt saw the Moon, for the first time, in a larger telescope. It was, therefore, at the Altona Observatory that he first obtained a fair notion of the wide field of inquiry still open to the observer of lunar objects; for not only was he captivated by the telescopic appearance of the craters of *Gassendi*, *Bullialdus* in the *Mare Nubium*, and other prominent objects which Dr. Petersen showed him, but he also had an opportunity of inspecting, also for the first time, the celebrated chart of Beer and Mädler, which in the future was destined to serve as what may be fittingly termed his working lunar catalogue. While a resident in Hamburg Schmidt was a frequent visitor at the Hamburg Observatory, when, through the courtesy of Dr. Karl Rümker, the instruments were occasionally placed at his service for the prosecution of his lunar observations. This permission proved to have been a great boon to the young student, as it enabled him, when necessary, to view the details on the Moon's surface with a higher power than that to which he was usually accustomed.

In 1845 Schmidt, then about twenty years of age, left Hamburg

to accept the appointment of assistant to Professor Benzenberg, who had established an Observatory at Bilk, near Dusseldorf, principally for the purpose of observing occasional astronomical phenomena, but more particularly of shooting-stars and other naked-eye objects, a class of observation in which Schmidt, as well as Benzenberg, was at the time specially interested; and also for the systematic search for supposed intra-Mercurial planets, a subject suggested by the recent publication of Le Verrier's researches on the theory of *Mercury*. Schmidt's lunar observations at Bilk were, however, of a negative character, for during his connection with that Observatory he was able to make only a very slight progress in his sketches of the Moon. This partial cessation of his favourite employment was not owing to any relaxation of energy on the part of Schmidt, but rather to the inferior instrument placed at his disposal for his own peculiar work; for it has been stated that Professor Benzenberg was so careful of his principal telescope that he feared that its outward good looks and polish would suffer had he permitted the young ardent astronomer to use it. Schmidt's connection with the Bilk Observatory was, however, very short, as on the death of Professor Benzenberg in the following year he transferred his services to the Bonn Observatory, where he remained under the direction of Professor Argelander till the year 1853. While an assistant at Bonn, Schmidt made good progress with his lunar researches, without neglecting the usual duties of the Observatory. In these he took his regular share of work, including observations of the positions of small stars for insertion in Hour V. of the Berlin Academy star-charts, as well as of new planets and comets and their comparison stars. Among the comets observed by Schmidt at this time we may refer to the observations of those of Mauvais and Brorsen, published in the *Astronomische Nachrichten* for 1848, and of Petersen and Goujon in 1849. Besides these comets he observed many others, the results of which have been communicated from time to time to the same periodical, including observations of the comets of Klinkerfues and Bruhns. A very important series of drawings of *Saturn* was made by Schmidt in 1848, at the time of the Saturnian equinox, consisting of seventeen sketches of the planet at about the time of disappearance and reappearance of the rings, the principal features in which indicated the possible existence of great inequalities of surface on the rings not previously observed. He also, while at Bonn, formed one of the German party of astronomers who selected Eastern Prussia as their place of observation of the total solar eclipse of July 28, 1851. His account of the eclipse was published at Bonn in 1852 under the title of "Beobachtung der totalen Sonnenfinsterniss zu Rastenburg," extracts from which may be found in Mr. Ranyard's collation of the observations made during total solar eclipses contained in the Society's *Memoirs*, vol. xli.

On the recommendation of Professor Argelander, Schmidt

was appointed in 1853 to take the direction of the Baron von Unkrechtsberg's private Observatory at Olmütz, in Moravia, where he continued his sketches of the lunar features—craters, rills, mountain ranges, &c.—accompanied by numerous micrometrical measurements. Here he remained till 1858. During a visit to the south of Italy in the months of March and April 1855, he took that opportunity of making special lunar drawings, first with the great Refractor at Rome, and afterwards at the Observatory at Naples.

On December 2, 1858, Dr. Schmidt entered upon his duties as director of the Observatory at Athens, where he remained in full activity as an astronomical observer of great reputation to the end of his life. He found this slightly-endowed Observatory in far from flourishing circumstances, and some time elapsed before he was able to bring the 6-feet Refractor by Plössl into a satisfactory adjustment. This preliminary work occasioned some unavoidable delay in his lunar researches, now far advanced; but when his instrument was brought again into working order, he soon made considerable progress, though a large portion of his observing time was devoted to the observation of variable stars, comets, meteors, and other miscellaneous phenomena, of which the resulting observations have been usually printed in the pages of the *Astronomische Nachrichten*. Some of Schmidt's cometary observations have, however, appeared in his "Astronomische Beobachtungen über Cometen," which forms Series I, vol. i. of the "Publications de l'Observatoire d'Athènes." The results of his observations of extraordinary meteors were, in 1867, published in an octavo volume, entitled "Ueber Feuer-Meteore, 1842 bis 1867." During the latter period of his lunar researches, knowing that the end of his preparatory labours, in anticipation of the formation of his long expected chart, was now approaching, most of Dr. Schmidt's time was devoted to the re-examination of what he had already done, and in filling up those portions of the chart which had hitherto been neglected, a work which necessarily occupied several years. At the same time he was always ready to pick up any new object visible to the naked eye, for he was a constant watcher of the heavens, and a new star or comet was rarely known to appear suddenly without its being soon detected by the keen and sensitive eyes which he was known to possess. In illustration of his knowledge of the constellations, as well as of his watchfulness, we need only refer to his early independent detection of the outbursts of the interesting variable stars *T Coronæ*, which suddenly appeared in May 1866, and *Nova Cygni*, which as suddenly became visible to the naked eye in November 1876. The former variable was observed first by Mr. Birmingham on May 12, and secondly by Dr. Schmidt on the following day; while the latter was first noticed by Schmidt, who made almost daily comparisons of its relative brightness from the day of the discovery of the outburst, November 24, to the middle of December, the magnitude

of the star during this period of three weeks having gradually diminished from the third to the seventh. This continuous series of comparisons of *Nova Cygni* was a very important one, as owing to some delay in making the outburst known to other observers, coupled with cloudy weather, Dr. Schmidt was the only person who had the good fortune to witness the star when at, or near, its maximum brilliancy.

Among the various astronomical labours of Dr. Schmidt, his celebrated chart of the Moon, for the most part completed in 1868, though not finally revised till July 1874—thirty-five years after his youthful determination in 1839 to undertake so extensive a work—will ever remain as the most permanent memorial of the great patience and energy displayed by him throughout this long period, which eventually enabled him to present to his astronomical colleagues this important contribution to selenography. Excellent, however, as the chart is, it would not be correct to say that it is perfect; on the contrary, many serious defects may be easily pointed out, including unavoidable faults arising from the reproduction of the chart by means of photolithography, a process that would effectually perpetuate all roughness of drawing, the defects of handwriting, or any injury that might have been caused to the delicate portions of the chart after the eight or nine years' working of Schmidt at the sections. In fact, the parallel and meridian lines on the map were obliterated by this cause, and an attempt was made in 1874 to restore them, but owing to the roughness of the surface of the paper, it was found that this could not be done satisfactorily. From the absence of these lines it is not possible to determine the exact positions of the different objects, which can only be inferred approximately from the graduations on the margin of the map. The photo-lithographic copies also show very clearly that the fainter portions of the lunar markings are greatly exaggerated, for there is not much distinction between the relative intensity of these and the darker mountainous ranges. This important defect becomes very apparent on comparing one of the sections with the corresponding one in Lohrmann's chart, which has been engraved on copper-plate. But, notwithstanding these and other serious blemishes, the whole chart as it stands, with its volume of descriptive text, still remains as a most creditable production by one person, though it be the result of a life-long labour. Dr. Schmidt, in the title to his work, names the map as a chart of the lunar mountains. It is divided into twenty-five sections, each complete in itself, with the usual graduations at the edges, to make it more convenient for reference to the positions of the various objects.

For some time before the completion of the chart, rumours were circulated among astronomers that it was very doubtful whether the results of all this labour of Dr. Schmidt would pass out of the manuscript form, owing to the small endowment of the Athens Observatory. It was evident that the Observatory

had no funds available to bear the expense of publishing the map in its entirety. But it was the opinion of many of those most interested in lunar work, that the chart ought to be in the hands of astronomers generally as soon as possible. On this ground the subject of finding means for its publication in England was discussed by a few of the Fellows of the Royal Astronomical Society, who were also very desirous that the results of Dr. Schmidt's labours should not be lost to the science. He was accordingly requested to forward an estimate of the probable expense of transferring the map upon stone by photo-lithography, or by any other method. Dr. Schmidt, however, proposed pecuniary conditions which, under the circumstances, were impossible to be entertained, and thus the question of publishing the chart in England was given up with regret. Fortunately for science, Dr. Schmidt, during a visit to Berlin in 1874, exhibited his chart at the Observatory, where it excited much admiration among scientific men, which eventually resulted in arrangements being made for its publication under the auspices of the Prussian Government. The Crown Prince was much impressed with the appearance of the chart, and used his influence in its favour with success. It was decided by the authorities that the twenty-five sections, of which the map was composed, should be photo-lithographed at the General Staff Office, under the direction of the Count von Moltke, from the original drawings of the chart as finally completed by Dr. Schmidt. The work was published at Berlin in 1878, under the title of "Charte der Gebirge des Mondes nach eigenen Beobachtungen in den Jahren 1840-1874. 25 Sectionen und Erläuterungsband," folio and quarto, containing the results of a series of more than a thousand drawings, and three times that number of measures of heights, omitting, as we have before stated, most of the sketches made previously to 1842, as these were not employed in the construction of the chart, on account of the first few years' observations having been considered by Dr. Schmidt to be comparatively imperfect. In addition to Schmidt's own lunar work, he also found time to prepare for publication Lohrmann's "Mondcharte in 25 Sectionen," of which only four had hitherto been published in the first part of Lohrmann's work. The unpublished sections came into his possession in an incomplete state many years ago, when he at once announced his intention of publishing them. But, owing to his time having been fully occupied on the revision of his own chart, he was unable to complete them for publication till 1875, which is the date given at the end of the preface. To this work he contributed the descriptive text, consisting, however, only of a very brief statement of the formations included in the sections. It was published at Leipzig in 1878.

The following extract from an interesting review of Dr. Schmidt's labours, written in 1879 by the late Mr. Birmingham, of Tuam, gives in few characteristic words an epitome of the difficulties and successes experienced by the distinguished astro-

nomer. It will form an appropriate conclusion to our brief remarks on his lunar researches : " In even a cursory examination of Schmidt's map, its completion by a single observer must seem almost incomprehensible to a man of ordinary powers ; but it requires protracted study to well realise the extent of the work. Any person who tries with the aid of a six-feet telescope to give closely detailed delineation of even a small area of the Moon, will soon conclude that the period of thirty-three years was comparatively a very short one for the accomplishment of Dr. Schmidt's great task. It is, in all truth, a performance highly creditable to the age in which we live, and to Teutonic intellect and perseverance. It is a splendid example from small beginnings. We have first, the astronomer, as a youth of fourteen, viewing the Moon with a little telescope, steadied by a lamp-post, and probably the laughing-stock of many a passer-by ; afterwards he is found, in maturer years, pursuing his favourite study under more or less difficult circumstances and in different countries, until, at length, as director of a national Observatory, he completes the wonderful production of his truly inimitable labours. For this it required all the unswerving persistence that is ever a chief attribute of genius ; and the pages of the *Astronomische Nachrichten* and other scientific publications can testify to the large amount of other astronomical work performed by Dr. Schmidt simultaneously with his lunar researches." (*The Observatory*, vol. iii. p. 16.)

Of Dr. Schmidt's miscellaneous astronomical observations, it is not necessary to say more in this place than that he was an indefatigable observer of double stars, variable stars, nebulæ, Sun-spots, the markings on the surfaces of the planets and the times of their rotation, meteors, the zodiacal light, and the physical appearances of comets, of which those of Brorsen, Tempel II., and Encke, described in the *Astronomische Nachrichten* for 1868, may be specially referred to. Dr. Schmidt's papers in this astronomical journal extend over a period of forty years, the title of the first memoir inserted in the Royal Society *Catalogue of Scientific Papers* to 1873, being "On the Periodicity of the Variable Star δ Cephei," contained in vol. xxi. for 1844. In this Catalogue the titles of 138 papers are given. In the ten following years this number must have been very considerably augmented.

Dr. Schmidt was admitted an Honorary Doctor of the University of Bonn, on the occasion of the foundation festival held in 1868, and he was elected an Associate of the Royal Astronomical Society on January 9, 1874. He continued in the full activity of his labours, and retained his character for acuteness for observing to the last. The same number of the *Astronomische Nachrichten* which contains the results of his last observations of variable stars, made during the year 1883, also gives his obituary notice. Dr. Schmidt had attended a reception at the German Embassy, at Athens, on the evening of Wed-

nesday, February 6, 1884, apparently in his usual health. On the morning of February 7 he was found dead in his bed, having expired suddenly some time during the night. Universal regret was expressed throughout the city on the announcement of his sudden death, and his funeral was fitly made one of national mourning, the King and Queen of Greece attending at the Observatory during the delivery of the funeral oration. At the time of his death Dr. Schmidt was in the fifty-ninth year of his age.

E. D.